

1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about boron and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Boron has been found in at least 21 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for boron. As EPA evaluates more sites, the number of sites at which boron is found may change. This information is important for you to know because boron may cause harmful health effects and because these sites are potential or actual sources of human exposure to boron.

When a chemical is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous chemical such as boron, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, life style, and state of health.

1.1 WHAT IS BORON?

Boron is a solid substance that widely occurs in nature. It usually does not occur alone, but is often found in the environment combined with other substances to form compounds called borates. Common borate compounds include boric acid, salts of borates, and boron oxide. Boron and salts of borate have been found at hazardous waste sites. Boron alone does not dissolve in water nor does it evaporate easily, but it does stick to soil particles. No information was found on whether common forms of boron evaporate easily or stick to soil particles; however, these forms do dissolve in water.

Boron is present in air, water, and soil, but no information is available on how long it remains in these media. There is also no information available on the occurrence of borates in the environment or on how long they persist in the environment.

Borates are used mostly in the production of glass. They are also used in fire retardants, leather tanning and finishing industries, cosmetics, photographic materials, with certain metals, and for high-energy fuel. Pesticides for cockroach control and wood preservatives also contain borates.

1. PUBLIC HEALTH STATEMENT

More information on the properties and uses of boron and boron compounds and how they behave in the environment may be found in Chapters 3, 4, and 5.

1.2 HOW MIGHT I BE EXPOSED TO BORON?

Boron occurs mainly in the environment through release into air, water, or soil after natural weathering processes. It can also be released from glass manufacturing, coal-burning power plants, copper smelters, and through its use in agricultural fertilizer and pesticides. It is estimated that releases from these sources are less than through natural weathering processes.

You can be exposed to boron in food (mainly vegetables and fruits), water, air, and consumer products. Infants, in particular, can be exposed to borates in products used to control cockroaches. Since boron is taken up from the soil by plants, it can enter the food chain. Although boron has been found in animal tissue, it does not accumulate and it is not likely that eating fish or meat will increase the boron levels in your body. Boron has been found in groundwater at very low levels. Background levels of boron up to 5 parts of boron in 1 million parts (ppm) of surface water have been reported. However, in dry areas where there are natural boron-rich deposits, boron concentrations can be as high as 360 ppm. No data were found on the occurrence of boron compounds in surface or groundwater. While current drinking water surveys do not report any levels of boron, it has been found in tap water in the past. Levels reported in drinking water were less than 1-3 ppm. There is potential for exposure to boron through contact with soil, since boron sticks to soil particles. Background levels up to 300 ppm have been reported. Exposure to air contaminated with boron is not likely to occur in the general population; however, there is risk of exposure to borate dust in the workplace. Concentrations from 1-14 milligrams of boron dust per cubic meter of air (mg/m^3) have been reported in borax mining and refining plants and at sites where boric acid is manufactured. Exposure to boron may also occur from the use of consumer products, including cosmetics, topical medical preparations, and some laundry products. The average daily boron intake has been estimated to be 10-25 mg.

Further information on how you might be exposed to boron is given in Chapter 5.

1.3 HOW CAN BORON ENTER AND LEAVE MY BODY?

Boron can enter your body when you eat food (fruit and vegetables) breathe borate dust in the air, and when damaged skin comes in contact with it. Because very small amounts of boron are present in all drinking water, boron can enter your body when you drink water. When boron enters the body by mouth or when you breathe borate dust, it goes to the intestines where it is passed to various parts of the body including the liver, brain, and kidney. No information is available on what factors affect how fast boron enters the body. However, animal studies suggest boron readily enters the body after contact with damaged skin. Most of the boron leaves the body in urine

1. PUBLIC HEALTH STATEMENT

primarily from food eaten. Over half of the boron taken by mouth can be found in urine within 24 hours and the other half can be detected for up to 4 days. Boron compounds can be found in urine up to 23 days if you are accidentally exposed to very large amounts.

Further information on how boron enters and leaves the body is given in Chapter 2.

1.4 HOW CAN BORON AFFECT MY HEALTH?

If humans eat large amounts of boron (4,161 ppm) over short periods of time, it can affect the stomach, intestines, liver, kidney, and brain and can eventually lead to death. Irritation of the nose and throat or eyes can occur if small amounts of boron (4.1 mg/m³) are breathed in. Boron can irritate the eyes if it comes in contact with them for long periods of time. Animal studies indicate that the male reproductive organs, especially the testes, are affected if large amounts of boron are eaten or drunk for short or long periods of time. Studies in animals also indicate delayed development and structural defects in offspring, primarily in the rib cage, from maternal exposure to boron during pregnancy. These effects have not been seen in humans. Irritation of the nose can occur in animals if large amounts of boron are breathed in for long periods of time. These effects have not been seen in humans. No information is available on whether boron is likely to cause cancer in humans. There is no evidence of cancer in animals exposed to boron for long periods of time.

More information on the health effects of boron in humans and animals can be found in Chapter 2.

1.5 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO BORON?

There are reliable and accurate ways of measuring boron in the body. Blood and urine can be examined to determine if excessive exposure to boron has occurred. Boron and, to a limited extent, boron-related compounds can be measured in body fluids. However, special equipment is needed for detection and analysis. Tests are not routinely available in a doctor's office. It is not known whether boron levels measured in the body can be used to predict potential health effects.

Further information on how boron can be measured in exposed humans is presented in Chapters 2 and 6.

1.6 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The federal government has set regulatory standards and guidelines to protect individuals from the effects that may occur if exposed to boron. The EPA has established tolerances for total boron of 30 ppm in or on cottonseed and 8 ppm in or on citrus fruits. The Food and Drug Administration has

1. PUBLIC HEALTH STATEMENT

designated that borax and boric acid are generally recognized as safe (GRAS) as indirect food additives in adhesive components, components of paper, paperboard, sizing and coatings. The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 10 mg/m³ for boron oxide and sodium tetraborate in the workplace air for 8 hour/day exposures over a 40-hour work week. Limits of 10 mg/m³ for boron tribromide and 3 mg/m³ for boron trifluoride have been set.

Additional information on governmental regulations regarding boron can be found in Chapter 7.

1.7 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns not covered here, please contact your state health or environmental department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road, E-29
Atlanta, Georgia 30333

This agency can also provide you with information on the location of the nearest occupational and environmental health clinic. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.